

# Freshwater Mussel HACCP Plan

## HACCP Step 1 – Activity Description

<b>Activity Description</b>	
Facility: Dale Hollow National Fish Hatchery	Site: Dale Hollow National Fish Hatchery
Project Coordinator: Rick Nehrling	Activity: Freshwater Mussel Propagation, Restoration, Recovery, and Refugia in the Tennessee and Cumberland River Basins
Site Manager: Andrew L. Currie	
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Phone: (931) 243-2443	

<b>Project Description</b> i.e. Who; What; Where; When; How; Why
<p>Dale Hollow National Fish Hatchery personnel work with Tennessee Cooperative Fishery Research Unit (USGS-BRD) personnel to collect gravid female mussels from the wild. Mussels are scrubbed and held in isolation at the Unit laboratory located at Tennessee Technological University, Cookeville, Tennessee. When the gravid mussels are deemed to be free of zebra mussels, gravid mussels are transported to the Imperiled Aquatic Species Culture Building located at Dale Hollow National Fish Hatchery. All mussel propagation/culture activities are confined to this building. Glochidia are flushed from the female mussels and are placed onto the gills of host fish. Once the glochidia transform into juvenile mussels and drop off of the host fish, they are collected and are placed into closed, re-circulation systems for culture. The focus of this activity is to develop propagation/culture procedures for threatened and endangered species of mussels indirectly, through the use of surrogate species. Techniques developed through these studies can then be used at a later date to propagate and culture listed mussel species so that they can be reintroduced into the wild.</p>

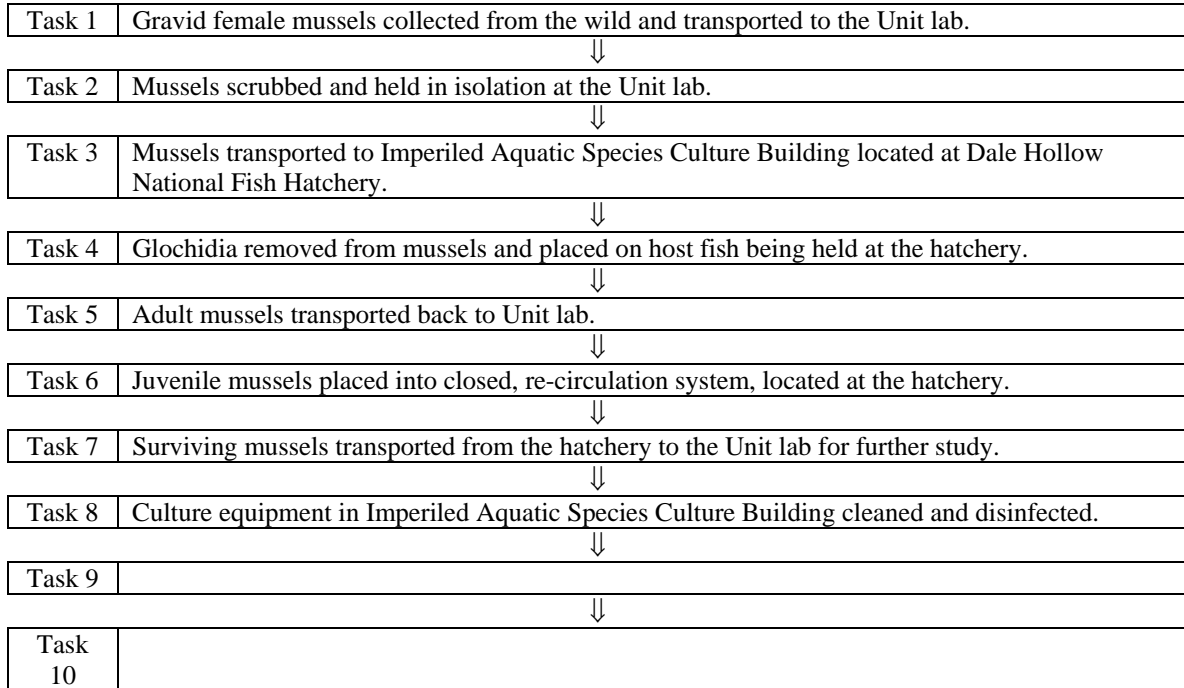
## HACCP Step 2 – Identify Potential Hazards

(to be transferred to column 2 of HACCP Step 4 – Hazard Analysis Worksheet)

<b>Hazards: Species Which May Potentially Be Moved/Introduced</b>
<b>Vertebrates:</b> None
<b>Invertebrates:</b> Zebra mussel ( <i>Dreissena polymorpha</i> ) Freshwater snail ( <i>Gastropoda</i> spp.) Asian clam ( <i>Corbicula fluminea</i> ) New Zealand mud snail ( <i>Polamopyrgus antipodarum</i> )
<b>Plants:</b> Eurasian watermilfoil ( <i>Myriophyllum spicatum</i> ) Hydrilla ( <i>Hydrilla verticillata</i> )
<b>Other Biologics (e.g. disease, pathogen, parasite):</b> Fish and mussel pathogens commonly found in the Tennessee and Cumberland River Basins
<b>Others (e.g. construction materials, etc.):</b>

### HACCP Step 3 – Flow Diagram

Flow Diagram Outlining Sequential Tasks to Complete Activity/Project  
Described in HACCP Step 1 – Activity Description



### HACCP Step 4 - Hazard Analysis Worksheet

1 Tasks (from HACCP Step 3 - Flow Diagram)	2 Potential hazards identified in HACCP Step 2	3 Are any potential hazards probable? (yes/no)	4 Justify evaluation for column 3	5 What control measures can be applied to prevent undesirable results?	6 Is this task a critical control point? (yes/no)
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<b>Task 1</b>  Gravid female mussels collected from the wild and transported to the Unit lab.	<u>Vertebrates</u> None	No	Adult mussels are captured by hand and placed in a cooler for transport.	All mussels are sorted and inspected. No vertebrates are collected.	Yes
	<u>Invertebrates</u> Zebra mussel, freshwater snail, Asian clam, New Zealand mud snail	Yes	Zebra mussels, freshwater snails, Asian clams, and New Zealand mud snails can be found on adult mussels.	Adult mussels are scrubbed to remove external aquatic nuisance species.	Yes
	<u>Plants</u> Eurasian watermilfoil, Hydrilla	Yes	Pieces of plant material (i.e., Eurasian watermilfoil, Hydrilla) can be found on adult mussels.	Any visible plant material is removed from the adult mussels at the collection site.	Yes
	<u>Others</u> Fish and mussel pathogens commonly found in the Tennessee and Cumberland River Basins	Yes	Mussel/fish pathogens inherent in the wild population.	Transport a minimal amount of water in the transport containers.	Yes

<b>Task 2</b>  Mussels scrubbed and held in isolation at the Unit lab.	<u>Vertebrates</u> None	No	Fish and other vertebrates not collected.	NA	No
	<u>Invertebrates</u> Zebra mussel, freshwater snail, Asian clam, New Zealand mud snail	Yes	Zebra mussels, freshwater snails, Asian clams, and New Zealand mud snails are not always visible.	Re-inspect mussels for ANS and re-scrub if necessary.	Yes
	<u>Plants</u> None	No	Plant material removed in Task 1. No plants in isolation system.	NA	No
	<u>Others</u> Fish and mussel pathogens commonly found in the Tennessee and Cumberland River Basins	Yes	Mussels may harbor pathogens internally and externally.	Mussels kept in isolation system.	Yes

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1 Tasks (from HACCP Step 3 - Flow Diagram)	2 Potential hazards identified in HACCP Step 2	3 Are any potential hazards probable? (yes/no)	4 Justify evaluation for column 3	5 What control measures can be applied to prevent undesirable results?	6 Is this task a critical control point? (yes/no)
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<b>Task 3</b>  Mussels transported to Imperiled Aquatic Species Culture Building located at Dale Hollow National Fish Hatchery.	<u>Vertebrates</u> None	No	Fish and other vertebrates not collected.	NA	No
	<u>Invertebrates</u> None	No	Zebra mussels, freshwater snails, Asian clams, and New Zealand mud snails removed in Task 2.	NA	No
	<u>Plants</u> None	No	Plant material removed in Task 1. No plants in isolated culture system.	NA	No
	<u>Others</u> Fish and mussel pathogens commonly found in the Tennessee and Cumberland River Basins	Yes	Mussels may harbor pathogens internally and externally.	Transport in minimal amount of water.	No

<b>Task 4</b>  Glochidia removed from mussels and placed on host fish being held at the hatchery.	<u>Vertebrates</u> None	No	Host fish kept in isolated culture system. No other vertebrates in system. Host fish disposed of after use. Host fish culture system disinfected after use.	NA	No
	<u>Invertebrates</u> None	No	Zebra mussels, freshwater snails, Asian clams, and New Zealand mud snails removed in Task 2.	NA	No
	<u>Plants</u> None	No	Plant material removed in Task 1. No plants in isolated culture system.	NA	No
	<u>Others</u> Fish and mussel pathogens commonly found in the Tennessee and Cumberland River Basins	Yes	Mussels may harbor pathogens internally and externally.	Mussels kept in isolated culture system.	Yes

### HACCP Step 4 - Hazard Analysis Worksheet

1 Tasks (from HACCP Step 3 - Flow Diagram)	2 Potential hazards identified in HACCP Step 2	3 Are any potential hazards probable? (yes/no)	4 Justify evaluation for column 3	5 What control measures can be applied to prevent undesirable results?	6 Is this task a critical control point? (yes/no)
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<b>Task 5</b>  Adult mussels transported back to Unit lab.	<u>Vertebrates</u> None	No	Vertebrates excluded in Task 1 and Task 4.	NA	No
	<u>Invertebrates</u> None	No	Zebra mussels, freshwater snails, Asian clams, and New Zealand mud snails removed in Task 2.	NA	No
	<u>Plants</u> None	No	Plant material removed in Task 1. No plants contained in transport container.	NA	No
	<u>Others</u> Fish and mussel pathogens commonly found in the Tennessee and Cumberland River Basins	Yes	Mussels may harbor pathogens internally and externally.	Transport in container dedicated to that sole purpose. Disinfect container after use.	No

<b>Task 6</b>  Juvenile mussels placed into closed, re-circulation system, located at the hatchery.	<u>Vertebrates</u> None	No	Vertebrates excluded in Task 1 and Task 4.	NA	No
	<u>Invertebrates</u> None	No	Zebra mussels, freshwater snails, Asian clams, and New Zealand mud snails removed in Task 2.	NA	No
	<u>Plants</u> None	No	Plant material removed in Task 1. No plants in isolated culture system.	NA	No
	<u>Others</u> Fish and mussel pathogens commonly found in the Tennessee and Cumberland River Basins	Yes	Mussels may harbor pathogens internally and externally.	Mussels kept in isolated culture system.	Yes

### HACCP Step 4 - Hazard Analysis Worksheet

1 Tasks (from HACCP Step 3 - Flow Diagram)	2 Potential hazards identified in HACCP Step 2	3 Are any potential hazards probable? (yes/no)	4 Justify evaluation for column 3	5 What control measures can be applied to prevent undesirable results?	6 Is this task a critical control point? (yes/no)
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<b>Task 7</b>  Surviving mussels transported from the hatchery to the Unit lab for further study.	<u>Vertebrates</u> None	No	Vertebrates excluded in Task 1 and Task 4.	NA	No
	<u>Invertebrates</u> None	No	Zebra mussels, freshwater snails, Asian clams, and New Zealand mud snails removed in Task 2.	NA	No
	<u>Plants</u> None	No	Plant material removed in Task 1. No plants contained in transport container.	NA	No
	<u>Others</u> Fish and mussel pathogens commonly found in the Tennessee and Cumberland River Basins	Yes	Mussels may harbor pathogens internally and externally.	Transport in container dedicated to that sole purpose. Disinfect container after use.	No

<b>Task 8</b>  Culture equipment in Imperiled Aquatic Species Culture Building cleaned and disinfected.	<u>Vertebrates</u> None	No	Vertebrates excluded in Task 1 and Task 4.	NA	No
	<u>Invertebrates</u> None	No	Zebra mussels, freshwater snails, Asian clams, and New Zealand mud snails removed in Task 2.	NA	No
	<u>Plants</u> None	No	Plant material removed in Task 1. No plants contained in transport container.	NA	No
	<u>Others</u> Fish and mussel pathogens commonly found in the Tennessee and Cumberland River Basins	Yes	Pathogens harbored internally and externally by mussels may be passed from one lot of cultured mussels to the next.	Clean and disinfect culture system with 200 mg/L chlorine.	Yes

## HACCP Step 5 – HACCP Plan Form

<b>HACCP Plan Form</b>								
<b>Critical Control Point (CCP)</b>	<b>Significant Hazard(s)</b>	<b>Limits for each Control Measure</b>	<b>Monitoring</b>				<b>Evaluation &amp; Corrective Action(s) (if needed)</b>	<b>Supporting Documentation (if any)</b>
			<b>What</b>	<b>How</b>	<b>Frequency</b>	<b>Who</b>		
(1) Gravid female mussels collected from the wild and transported to the Unit lab.	Unintentional spread of Zebra mussel, freshwater snail, Asian clam, New Zealand mud snail, Eurasian watermilfoil, Hydrilla, and fish and mussel pathogens.	Juvenile invertebrate ANS and microscopic pathogens hard to detect.	Presence of ANS.	Visual and microscopic inspection.	Each time gravid female mussels are collected from the wild.	Hatchery and Unit personnel taking part in collection activities.	Unit site supervisor responsible for following protocol.	Records in daily log book.
(2) Mussels scrubbed and held in isolation at the Unit lab.	Unintentional spread of Zebra mussel, freshwater snail, Asian clam, New Zealand mud snail, and fish and mussel pathogens.	Microscopic pathogens hard to detect.	Presence of invertebrate ANS.	Visual inspection.	If invertebrate ANS present, re-scrub and leave mussels in isolation system.	Unit personnel	Unit site supervisor responsible for following protocol.	Records in daily log book.
(4) Glochidia removed from mussels and placed on host fish being held at the hatchery.	Unintentional spread of fish and mussel pathogens.	Microscopic pathogens hard to detect.	Presence of microscopic ANS.	Microscopic and diagnostic inspection.	Whenever adequate numbers of a non-listed species are available.	Warm Springs Fish Health Center, GA.	Hatchery personnel responsible for maintaining study organisms in an isolated culture system at all times.	Records in daily log book.  Fish Health Inspection Report
(6) Juvenile mussels placed into closed, re-circulation system, located at the hatchery.	Unintentional spread of fish and mussel pathogens.	Microscopic pathogens hard to detect.	Presence of microscopic ANS.	Microscopic and diagnostic inspection.	Whenever adequate numbers of a non-listed species are available.	Warm Springs Fish Health Center, GA.	Hatchery personnel responsible for maintaining study organisms in an isolated culture system at all times.	Records in daily log book.  Fish Health Inspection Report
(8) Culture equipment in Imperiled Aquatic Species Culture Building cleaned and disinfected.	Unintentional spread of fish and mussel pathogens.	Adequate contact between ANS and chlorine required for effective disinfection of equipment.	Disinfection protocol.	Monitor disinfection process.	Whenever culture equipment is cleaned and disinfected.	Hatchery personnel taking part in cleaning and disinfection activities.	Hatchery site supervisor responsible for following protocol.	Records in daily log book.
<b>Facility:</b>	Dale Hollow National Fish Hatchery					<b>Activity:</b>	Freshwater Mussel Propagation, Restoration, Recovery, and Refugia in the Tennessee and Cumberland River Basins	
<b>Address:</b>	145 Fish Hatchery Road Celina, TN 38551-6268							
<b>Signature:</b>						<b>Date:</b>		
<b>HACCP Plan was followed.</b>								

